Collimator Control

Circuit/Mechanical Descriptions

The purpose of collimation is to prevent exposure to X-rays of anything beyond the film cassette in film mode, or the image intensifier in fluoro mode. It also lets you expose smaller areas for reasons of safety and improved imaging. The following sections describe the hardware that performs the collimation function, their location, function, and their operational interface among each other and the rest of the UROVIEW 2800 system.

Hardware Description

The hardware that provides collimator control function is located in two places---the Collimator Housing, and the X-ray Control Console (XCC).

Collimator Housing items consist of:

- Collimator assembly
- Collimator Interface assembly
- Switch matrix (also called collimator housing control)
- Vacuum Fluorescent Display (VFD)

The items within the XCC consist of:

- X-Ray Control Interface Assembly
- VFD, same as above
- Switch Matrix

The Collimator assembly consists of the collimator unit and externally attached DC control PCB. Field service within these items is not covered in this manual.

The collimator unit contains lateral and longitudinal collimators, motors, and potentiometers. The leaves correspond to the lateral and longitudinal orientation of the table. Each set of leaves is controlled by a separate motor. Potentiometers provide motion tracking.

The DC control PCB mounts externally to the collimator unit case. With X-ray head covers removed, you can view LEDs on this card that indicate presence of motor drive power when you are moving the leaves.

Note: Some of the Uroview system technical drawings show connections for the iris type collimator. These references are not applicable.

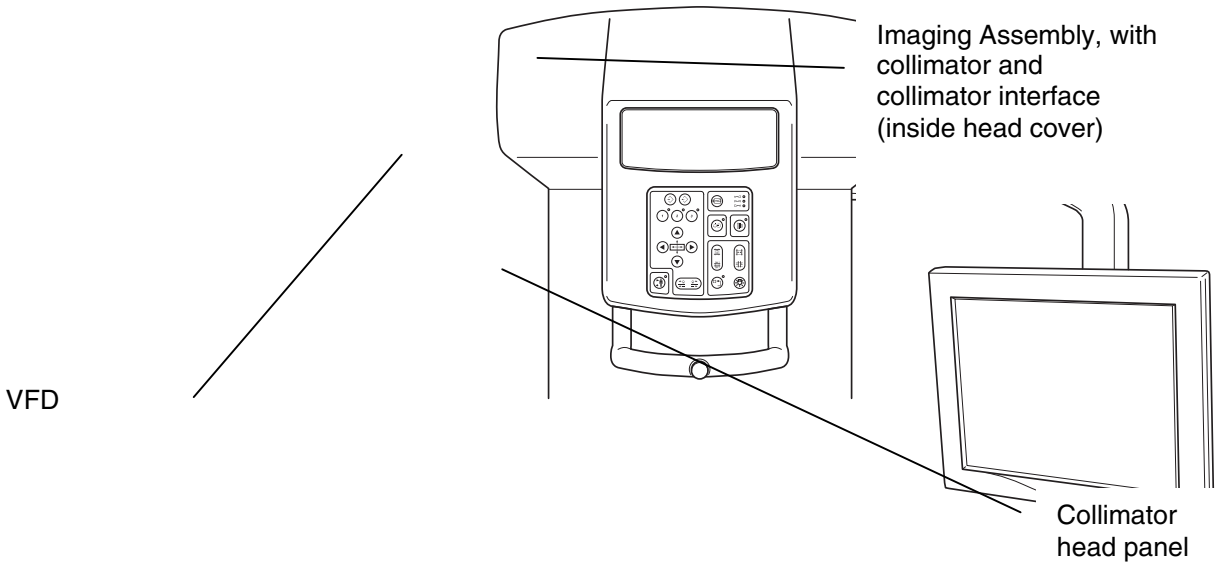
The Collimator Interface and X-ray Control Interface assemblies consist of hardware housed within an EMI enclosure. This manual does not cover service to any of them. Attached inside the enclosure is an ISA backplane with slots for:

- CPU PCB (ISA half-size CPU).
- Collimator (or X-ray) Control Interface PCB

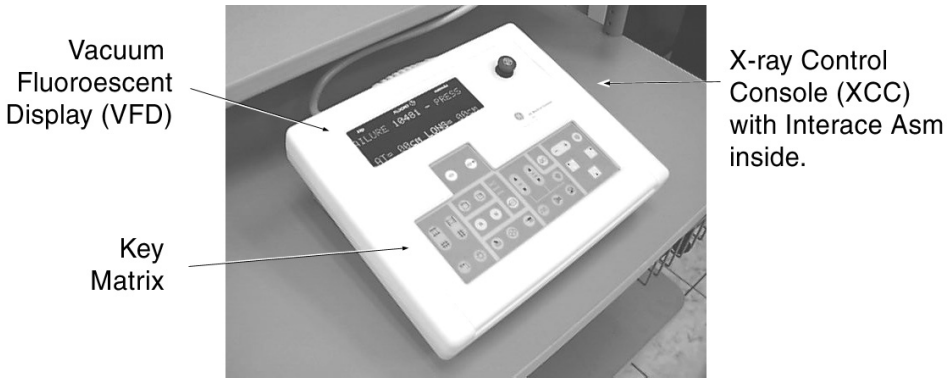
The switch matrix contains the pushbuttons and indicator LEDs for operating the collimator--either from the Collimator Housing Panel, or from the X-ray control console. It also provides controls for imaging assembly longitudinal movement, field size, film mode, and alarm reset.

Location

The following illustration shows location of the collimator hardware described above.



Collimator Housing Assemb



X-ray Control Console

Circuit Description

This section describes the collimation control function. The Collimator Control Interface and the X-ray Control Interface PCBs interface with the collimator unit, collimator head (switch matrix), VFD , and the ISA CPU PCB. The interface PCBs also communicate with the rest of the Uroview 2800 system through ARCNET. These general concepts are illustrated in the next drawing, *Collimator Control Circuit Description.*

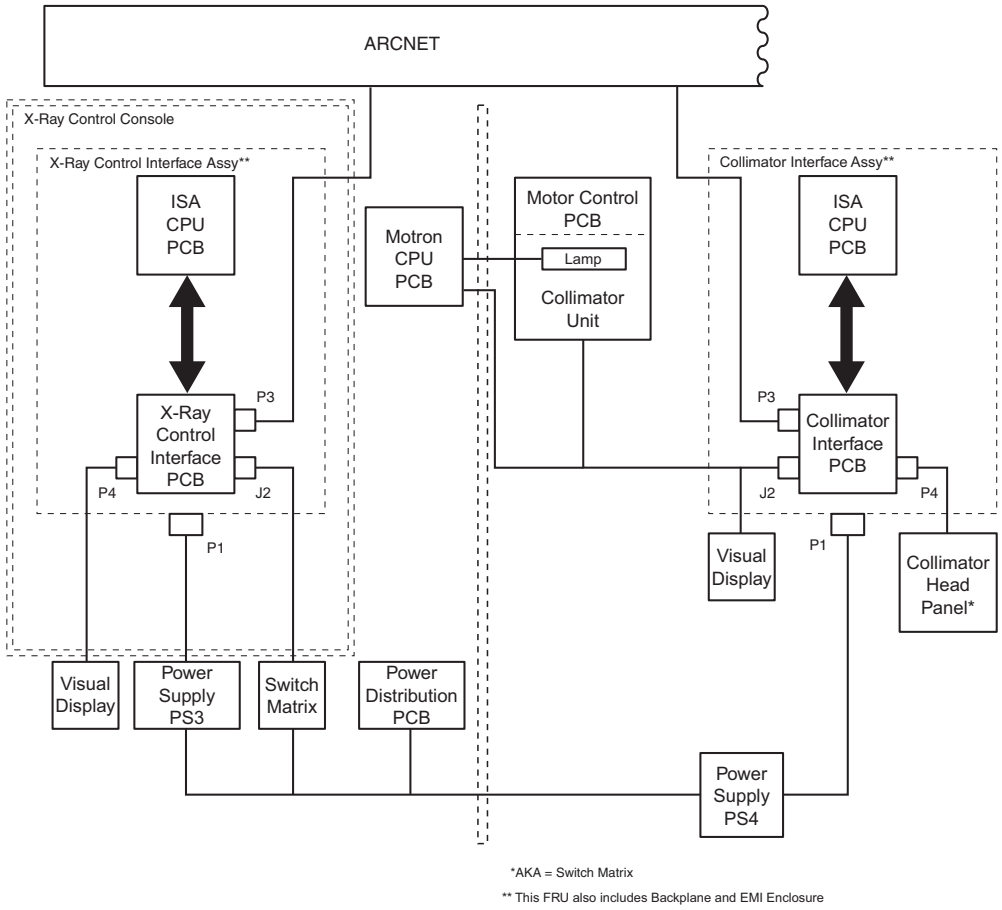
Collimation control consists of the following sub-functions:

- Power
- Human Interface and VFD
- Motor Drive and Position Sensing
- Digital communication

Power

Control power for the X-ray and Collimator Interface PCBs is 5 VDC. The collimator motors are driven by 24 VDC. The 5 VDC is supplied by PS3 and PS4. The 24 VDC comes from the Table CPU PCB.

PS3 supplies 5 VDC to P1 of the X-ray Control Interface PCB, for primary power to the switch matrix and the VFD in the XCC. In the Collimator Housing Panel, PS4 supplies 5 VDC to P1 of the collimator control interface PCB for switch matrix and VFD primary power, and as reference voltage for the collimator potentiometers.



Collimator Control Circuit Description

The Table CPU PCB, located in the tower, supplies 24 VDC to the Collimator Interface PCB for collimator motor drive power.

Human Interface and VFD

The human interface for collimation control occurs at the XCC and the Collimator Housing Panel. In each location, the user presses buttons relating to collimator control, and views LEDs on a switch matrix. In both locations, the VFD communicates messages about the status of not only the collimation, but other functions as well. You can control and monitor collimator functions equally from either station.

When you press a collimator motion control button on the switch matrix, the resulting message is comprised of a COL (column) signal and a ROW signal that uniquely identifies which button was pressed. The COL/ROW message transmits to the collimator control interface PCB via P4.

Also at P4, the control interface PCBs send LED status signals back to the switch matrix. For the collimation function, only PRESET is applicable.

The VFDs display collimator status messages, as well as information about other areas of the system. The interface PCBs process status input into serial data and move it serially via J2 to the respective VFDs. The DATA signal carries all information to the VFD. The data can be delivered only when the PCBs get the BUSY signal back from the respective VFD, received at J2.

When the Lamp key is pressed, the key press is communicated to the Table/Generator Interface PCB via ARCNET communication. The Table/Generator Interface CPU communicates the key press to the Table CPU via the Table Motion I/O Bus. The Table CPU starts a timer and simultaneously closes a relay that provides 20 VAC power and turns on the lamp within the collimator housing. Once the set time has elapsed, the Table CPU opens the relay, which removes the 20 VAC power signal and turns off the lamp.

If the Lamp switch is pressed prior to the time elapsing, the CPU will reset the timer extending the time that the lamp remains illuminated.

Motor Drive and Position Sensing

The method by which collimation control commands are communicated to the collimator from the XCC differs from that of the Collimator Housing Panel.

On the Collimator Housing Panel, when you press a collimator control button, the signal from the collimator control interface PCB goes via J2 to the collimator assembly to energize the motors, and move the leaves.

On the X-ray control console, when you press a collimator button, the X-ray control interface PCB processes the signal digitally and communicates it to the ISA CPU PCB for placing on the ARCNET. On the Collimator Housing Panel, the ISA CPU PCB pulls

collimator information from the data stream, and passes it to the collimator control interface PCB, where the digital data is converted to collimator control commands and the collimator motors are energized.

On the Collimator Housing Panel, position data generated by the collimator pots returns via J2 to the interface PCB, where it is processed digitally, sent to the ISA PCU PCB, and placed on the ARCNET. At the X-ray control console, the position data in digital form is converted to serial data and communicated to the VFD as described previously.

Digital communication

At the interface PCB level, analog voltages and serial data are converted to RS485 format and communicated via backplane connector to the ISA CPU PCB, which places the information on the ARCNET system. That information is shared and exchanged between the two nodes.

There is also the ARCNET communication between the workstation and the rest of the system. Configuration parameters are retained as system defaults and are part of the ARCNET data available at all times to the collimation control components.

The following user configurable collimation parameters are set on the workstation HI screen:

- RESET TO HOME
- RETAIN LAST

The following collimation parameters are configurable through the Utilities Software.

- Collimate Film Edges Option
- Display units (inch/cm)
- Lateral collimator stop position
- Longitudinal collimator stop position
- Collimator film size positions
- Collimator linear parameters (offset and slope values that allow the calculation of collimator opening from raw position data).

For more information, see the section below called *Adjustments*.

Fault Isolation

Functional Test	Failure	Possible Cause
Perform Power test first. If passes, perform Motor Drive and Position Sensing Test.	No response to pressing any collimator control button. System error message that collimator stuck	Defective collimator interface; defective collimator.
	No collimator movement; no error message	Defective collimator head panel (switch matrix) or collimator interface PCB.
	Button press results in appropriate collimator movement; system error message.	Bad pot in collimator. Replace collimator unit.
Human Interface and Display Test	VFD blank or image does not change	Power failure of power supply (PS3 or PS4)
		Defective interface PCB
	The Collimator Housing Panel VFD is lit up, but will not display collimation data, and the XRC VFD is OK	Faulty VFD.
	The XRC VFD is lit up, but will not display collimation data and the VFD is OK	Faulty XRC VFD.

Functional Test	Failure	Possible Cause
Perform the Collimator Lamp Test	Lamp fails to illuminate	Faulty switch. Press the second Lamp switch. If the lamp still fails to illuminate check the following: • Table Motion Bus • Table relay closure If pressing the second lamp switch lights the lamp, check the following: • Lamp switch • Wiring • ARCNET
	Lamp fails to turn off	Faulty timer

Functional Tests

Perform system initialization tests as required in *Uroview Subsystem* chapter. If error messages occur or other performance criteria fail, follow the procedures of this section.

Power

Perform this test to make sure that collimation error message is not due to power failure.

1. Remove upper covers from X-ray arm assembly.
2. On the top of the X-ray arm assembly, verify power input to PS4 at TB5.
3. Check for blown fuses F1, F2, or F3, located inside the Collimator Housing assembly.
4. Verify power input to PS3, and check for blown fuses F1. F2, or F3 in the XCC.

Human Interface and Display

Perform this test if the Collimator Housing Panel VFD is lit up, but will not display collimation data, and the XCC VFD is OK:

1. Check PS4 output or blown fuses.
2. Verify that if you use the collimation buttons of the Collimator Housing Panel switch matrix, the results are reflected on the other VFD.

If the XCC VFD is lit up, but will not display collimation data and the Collimator Housing assembly VFD is OK:

1. Check PS3 output or blown fuses.
2. Verify that if you use the XCC buttons, the results are reflected on the other VFD.

Motor Drive and Position Sensing

Perform this test if the collimator moves in correct response to all buttons, yet the system displays a collimator error message. You will need a DMM to measure voltages at motor drive power test points.

1. Remove Collimator VFD housing and Collimator Interface Assembly. Temporarily suspend Collimator Interface Assembly using a cable tie, and re-connect the cables
2. Initialize the system, and confirm the failure.
3. Locate the DC control PCB.
4. While an assistant presses any movement button, check voltage across TP 5 and TP11. The voltage should change when any movement button is pressed, between 0 and +5 VDC. If the voltage changes, replace the interface assembly. If the voltage does not change, replace the collimator assembly.

Use this test if no movement occurs, and the expected error message is displayed.

1. Perform step 1 of previous procedure.
2. Initialize the system and confirm the failure.
3. Locate the DC controller PCB.
4. While an assistant presses a movement button, observe the corresponding driver LED.
5. When the button is pressed, and the LED does **not** illuminate, replace the collimator interface assembly. If the LED illuminates, replace the collimator assembly.

Field Lamp (Collimator Lamp)

1. Press the Lamp key.
2. Verify that the Lamp illuminates and then shuts off after the timer has completed counting down.

Digital communication

Perform this test if a collimator movement fails, yet no error message occurs, indicating that the software has failed to detect a movement failure.

1. Perform system initialization.
2. Press each collimation control button on the collimator head panel, noting which motion(s) failed. For each, confirm that no errors occur.
3. Repeat the previous step on the X-ray control panel. If the motion failure recurs, and the XCC VFD displays the expected error message, the communication problem may be in the ISA CPU PCB or backplane connections. Replace the collimator interface assembly.
4. If the expected error message does not appear at the XRC, the probable cause is communication between the workstation and the rest of the system.

Adjustment

The following collimation parameters are configurable through the Table Motion Software.

- Collimate Film Edges Option
- Display units (inch/cm)
- Lateral collimator stop position
- Longitudinal collimator stop position
- Collimator film size positions
- Collimator linear parameters (offset and slope values that allow the calculation of collimator opening from raw position data).

To modify these parameters, access the *Parameter List* utilities screen as follows:

1. Remove the Tower's Top Cover to access the service switch and RS-232 port. Refer to the Replacement section if necessary.
2. Connect the RS-232 serial cable (female to male) between the serial port on your laptop and the 9-pin sub D serial port located near the service switch.
3. Start the Utility Suite on your laptop.
4. Click on the Tools pull-down menu and select *URO Service Tool* to launch the software application.
5. When the disclaimer window is displayed click on the *I Agree* button.

6. When the COM Port window appears, configure the COM Parameters as shown in the table:

COM Parameter	Value/Setting
Baud Rate	19200
Handshake	XON/XOFF
Parity	No
Data	8
Stop	1
COM Port	COM 1

7. Click the *Ok* button.
8. When the *Ok Now?* window displays, click the *Yes* button.
9. On the *Save Configuration File?* window, click *No*.
10. When the Service & Installation Tool Window appears click on the *Parameter* button.

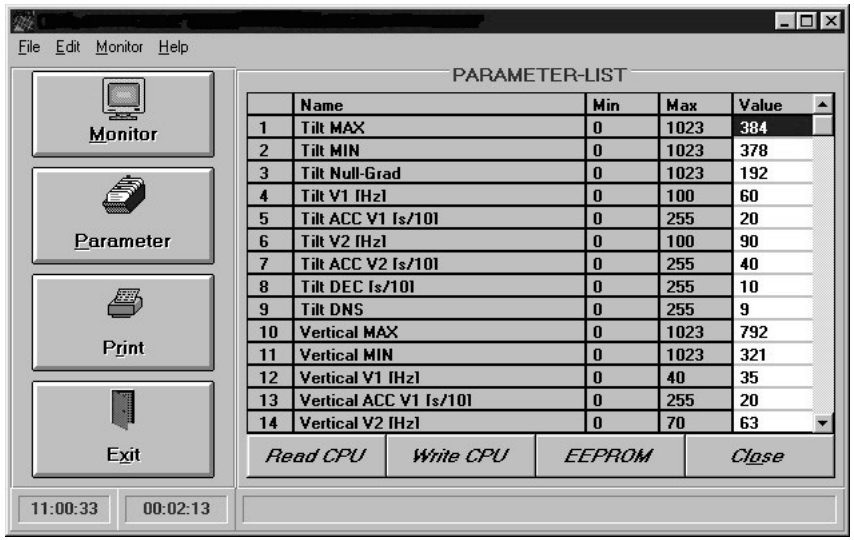
UROMAT 3000 Service & Installation Tool Window

11. When the Open window appears select the *.hpo file from the subdirectory listing**.**

*Note: If you have previously worked on this system and stored a calibration file on your hard-drive. Find the subdirectory for this system and locate the *.hpp file. When the edited data is saved, it is saved as a *.hpp file. The *.hpo file contains default calibration data.*

12. Click *Ok*.
13. When the *Firmware Information Window* appears, click *OK* and then the *Parameter List* window will appear,

CAUTION: Use care when changing values in the Parameter List. Incorrect values may cause the table to malfunction.



Parameter List Window

Change Collimator Lamp Timeout

1. Access the *Parameter List* utility screen, as shown above.
2. Flip the Service switch located on the Table CPU PCB to the up position. The LED should stop blinking.
3. Click on the *Read CPU* button to load the established parameters from the table into the Parameter List window.
4. If the transfer was successful click *Ok*. If a Timeout Error message is displayed, check the serial cable connection and Service Switch position.
5. When the Firmware Information window displays, click on *Ok*.

CAUTION: It is important to read the CPU value from the firmware prior to making changes and saving the data. Reading the CPU values first will ensure that unintentional changes to parameters do not occur.

6. Click the Read CPU button on the Parameter List window.
7. Place your cursor in the Value Column of the Light Time(s) and click.
8. Press the Backspace key to delete the current value.
9. Enter the amount of time you desire (1-60 seconds). Default is 30 seconds.
10. Click on the *Write CPU* button.
11. Click on the EEPROM button.
12. Place the Service Switch to the down position.
13. Cycle the power by turning the Workstation power switch off and then on.
14. When the LED (LED next to Service Switch) starts blinking the system has completed booting. Place the Service Switch to the up position.
15. From the Parameter List window, press the *Read CPU* button.
16. Click *OK* on the *Transfer Successful* window.
17. Click *OK* on *Firmware Information* window.

18. Click on the *File* pull-down menu and select *Save As*.
19. Enter a file name and save the calibration file to your laptop hard drive or floppy diskette.
20. Place the Service switch to the down position prior to reinstalling covers.

Miscellaneous

(Not applicable)